Distributed Interactive Simulation Exercise Control Toolset (DISECT)

Distributed Exercise Management (DEM)

Presented to
Federation Management Working Group

July 22, 1997

Greg Schow
STRICOM-Lead Systems Engineer
schowg@stricom.army.mil
(407) 384-3870

A Brief History of DEM and its Relationship with MOM

- **Nov 95**   STRICOM DISECT program initiated
- **Apr 96**   DISECT DEM funded by DARPA as a component of STOW'97
- **Jun 96**   DEM submits suggestions to AMG through STOW/SEID for management extensions to HLA/RTI
- **Aug 96**   DEM submits MOM requirements to Lincoln Labs for RTIs
- **July 97**   STOW FST2 testing of MOM measurements with RTIs-C5
- **Currently**   Adding automated alarms, refining DEM and GUI, and developing failure mode recovery heuristics

Slide # 2

Distributed Exercise Management

The DEM Toolset development consists of the following 6 tools:

- Run Time Infrastructure (RTI) Tool which monitors RTI behaviors.
- Network Analysis Tool for real-time network monitoring and status.
- Computer Load Analysis Tool which monitors performance metrics of individual computers in the simulation.
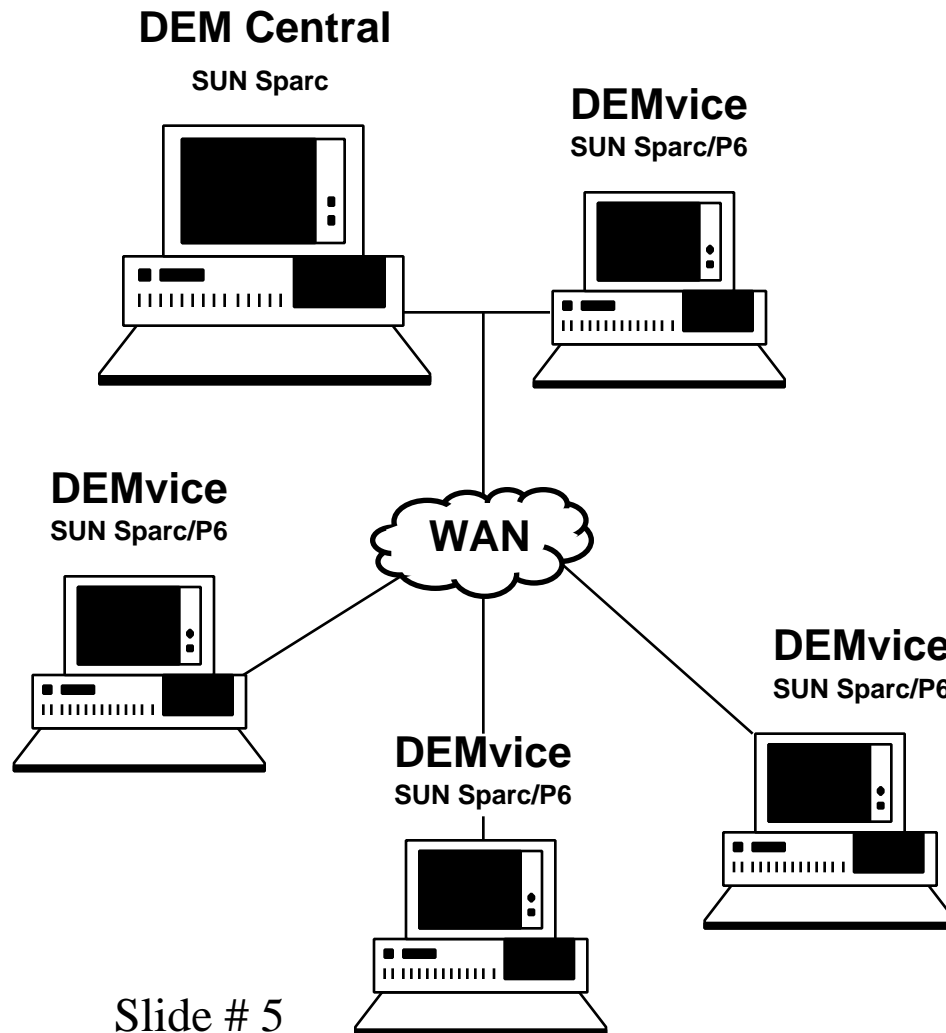
Distributed Exercise Management
(Cont.)

- **Run Time High Level Architecture (HLA) Exercise Control Tool which allows management of an exercise with federation create, destroy, pause, resume, save, restore, and federate kill.**

- **Computer Load Balancing Tool which can balance work loads between computers.**

- **Scenario Load Balancing Tool which can control exercise loading on the network.**

DEM Configuration For STOW'97

DEM Central

SUN Sparc

DEMvice

SUN Sparc/P6

DEMvice

SUN Sparc/P6

WAN

DEMvice

SUN Sparc/P6

DEMvice

SUN Sparc/P6

Slide # 5

DEM Central:
- Located at central location of WAN
- RTI Monitoring
- HLA Exercise Control
- Receives alarms from DEMvices
- Logs exercise statistics
- LAN-to-LAN connectivity

DEMvices:
- Located at each simulation LAN
- Network load monitoring
  - Packets in/out
  - Errors in/out
  - Collisions
- Workstation monitoring:
  - CPU utilization
  - SAF frame rate
- LAN-to-LAN Latency
- Alarms for CPU and network overload conditions
- Logs local LAN statistics
- Forward data and alarms to DEM Central
- MOM Channel monitoring

STOW 97 Network

Slide # 6

DEM Capabilities

DEM Central

DEMvice

WAN
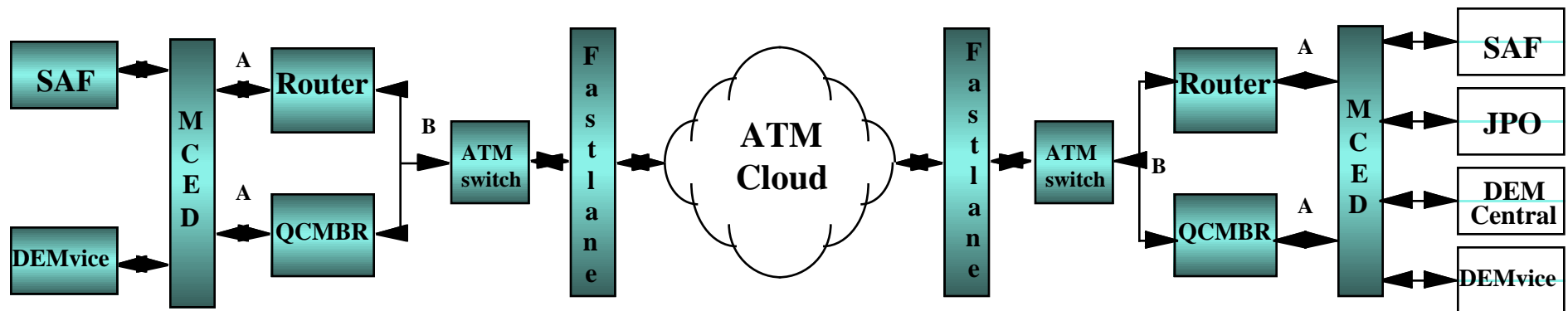
DEMvice

DEMvice

Exercise Logging

Informix used for logging RTI and exercise control data logged at DEM Central
LAN-level data (network, SAF frame rate, MOM channel) logged at each DEMvice

Data is available for review during or after the exercise

DEM Central provides a remote query to access any DEMvice database
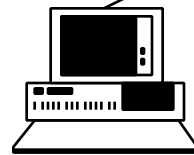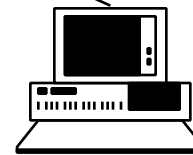
Exercise Control

| Create/Destroy Federation |
| Pause/Resume Federation |
| Save/Restore Federation |
| All control commands are timestamped and displayed |

Exercise Monitoring

DEM Central	DEMvice
RTI Monitor	Network Load Monitoring
• Federate Monitoring through MOM • RTI Updates Per Minute • DEM Central CPU Monitor	• Packets In/Out • Errors In/Out • Collisions
Able to remotely view LAN-level data generated by all DEMvices	Host Load Monitoring • CPU Utilization • SAF Frame Rate
Receives alarms from DEMvice	Generates and forwards alarms
LAN-to-LAN Connectivity	LAN-to-LAN Latency

Slide # 7

Status of DEM

- Completed RTIs-C5 integration into DEM Central.
- Completed integration of the MOM reporting for the STOW release of RTIs.
- Completed DEM Central RTIs MOM Logging capability.
- Have completed STOW 97 FST2 the first limited operational use of DEM.

DEM Uses of MOM Information

- **Provide the Exercise controller the means to effectively manage an exercise.**

- **Trigger Automatic Alarms to Help Detect Federation Failure Modes.**

- **Provide Insight Into Real-World Performance of RTIs and Federation Functionality.**

- **Extend Network Monitoring to Federation Level.**

DEM Uses of MOM Information (Cont.)

- **Provide Tracking of Entities as Simulations Progress and Entities Migrate.**

- **Aid in Failure Mode Analysis.**

MOM's Contribution to DEM

- RTIs Version
- Federate Hostname
- Federation State (Paused or Running)
- Total Updates Received
- Filtered Updates Received (filtered by relevance to the federate)
- Bundling Effectiveness

- Bundling Size
- Packets In for Best Effort, Minimum Rate, State Consistent and Reliable
- Packets Out for Best Effort, Minimum Rate, State Consistent and Reliable
- NAK Packets for State Consistent

Slide # 11

DEM Screen Shots

Netmon: In Packets	
0	Peak: 4.00	512

seid18 (Peak 1.67) 0.67

lager (Peak 3.33) 1.33

seid22 (Peak 4.00) 2.67

Frame Rate	
0	Peak: 14.00	15

seid18 ** Not Reporting **

lager (Peak 14.00) 13.24

Slide # 12

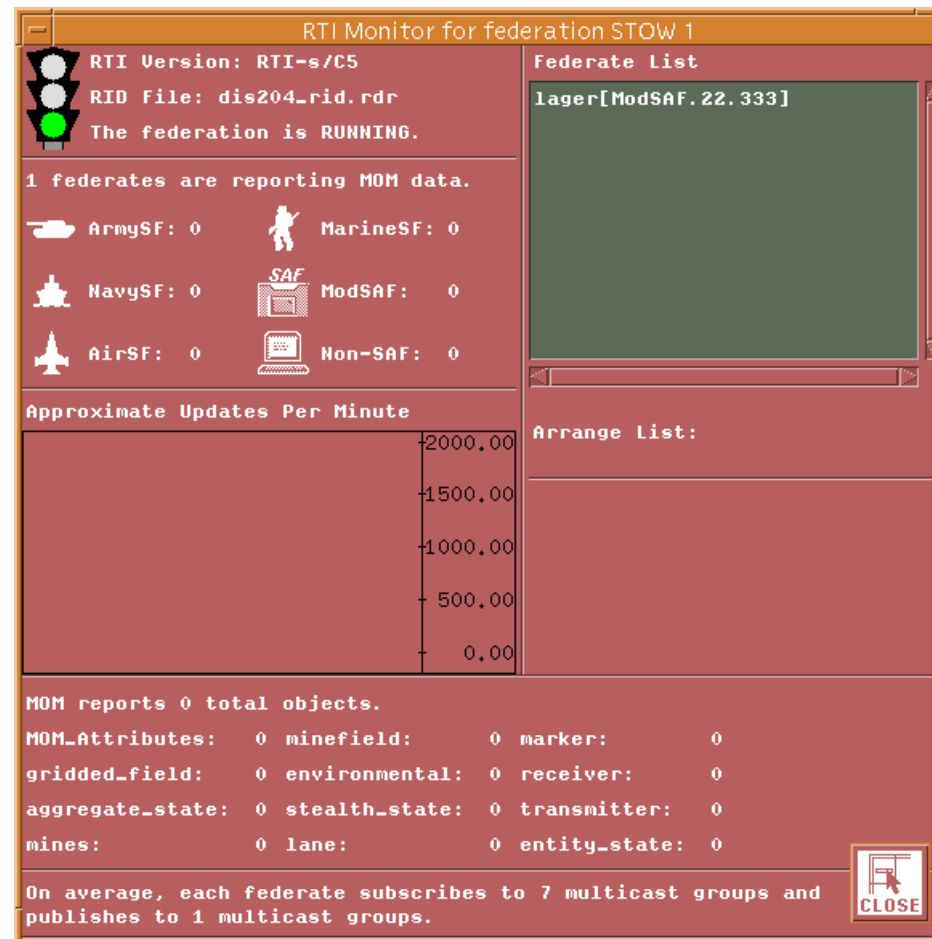# DEM Screen Shots

DEM Screen Shots
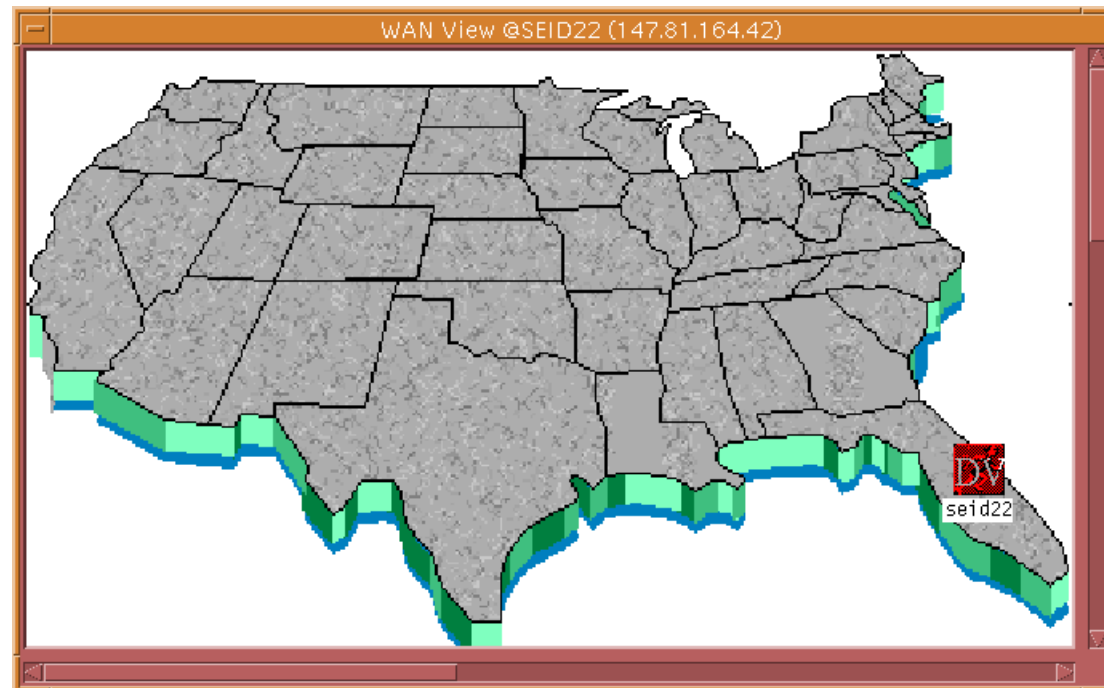
DEM Screen Shots

DEM Screen Shots

DEM Screen Shots

Preliminary MOM function utility

- **FederationID - Federation name**

- **FederateID - Federate name**

- **FederateHostID - Federate hostname**
  - All are necessary, since they identify the federate from which MOM data is coming.

- **State - Shows whether the federate is paused or running.**
  - Nice to know, may be useful for future debugging, hasn't been used much yet though.

Preliminary MOM function utility (cont)

- **UpdatesReceived - Total updates received by the federate's RTI.**
  - Somewhat useful, gives a rough idea of how much RTI data is going to any machine at any time.

- **FilteredUpdates - Total updates that are of interest to the federate.**
  - Hasn't been used much yet, but this should prove very useful when judging the effectiveness of the MCED (i.e. if the MCED is working perfectly, then Filtered Updates should equal UpdatesReceived for all federates)

Slide # 19

Preliminary MOM function utility (cont)

- **MinimumRateTransmitCount**
- **MinimumRateReceiveCount**
- **StateConsistentTransmitCount**
- **StateConsistentReceiveCount**
- **ReliableTransmitCount**
- **ReliableReceiveCount**
- **BestEffortTransmitCount**
- **BestEffortReceiveCount - The number of RTI updates send and received via the different RTI transport mechanisms.**
  - **- These numbers are interesting, and may be useful for AAR, but have been of little use in debugging and running an exercise.**

Slide # 20

Preliminary MOM function utility (cont)

- **MulticastGroupsSend**

- **MulticastGroupsReceive - The count of MC groups to which a federate is subscribed for sending and receiving updates.**
  - This may have nominal debugging/monitoring importance, but has had little actual use to date.

- **ObjectCountByClassLocal**

- **ObjectCountByClassRemote - The number of local and remote objects, listed by class, of which a federate is aware**
  - These stats have been extremely useful in running an exercise, as it is often important to know how many entities (or other objects) exist within a federation at any given time.

Preliminary MOM function utility (cont)

- **BundlingEffectiveness - The percentage of packets saved through the use of bundling**
- **BundlingSize - The average size of a bundled packet**
  - **- These are useful as a stat for determining RTI efficiency, more in AAR than in runtime, though**

Future Plans for DEM

- **Modify DEM to execute with RTI 1.0 in addition to RTIs-C1.**

- **Continue to track Lincoln Labs updates to RTIs for STOW.**

- **Track RTI Progress (Entity Migration).**

- **Develop failure mode heuristics**

Summary

- **DEM provides the Exercise Manager with a window into the State of the Exercise.**
  - **Real-time monitoring and alarms**
  - **The means to control the exercise**
- **DEM is a hierarchical scaleable tool suitable for simulation exercises.**
- **DEM provides a substantial return on investment.**
  - **Reducing cost and manpower**
  - **Decreasing turnaround time**
  - **Improving quality of products**
- **The MOM is central to the success of DEM.**

Slide # 24